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July 25, 2012
L-12-271

10 CFR 50.90

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
Docket No. 50-334, License No. DPR-66
Docket No. 50-412, License No. NPF-73
License Amendment Request to Modify Technical Specification 3.1.3, "Moderator Temperature Coefficient Measurement (MTC)," to Provide an Exemption Under Certain Conditions

Pursuant to 10 CFR 50.90, FirstEnergy Nuclear Operating Company (FENOC) hereby submits an amendment application for the operating licenses for Beaver Valley Power Station, Unit Nos. 1 and 2. The proposed amendments would modify Technical Specification 3.1.3 to allow exemption from the required near-end of life MTC measurement under certain conditions. If these conditions are met, the MTC measurement would be replaced by a calculated value.

An evaluation of the proposed amendment is provided as an enclosure. To allow for normal Nuclear Regulatory Commission (NRC) processing, FENOC requests NRC approval by August 2, 2013. Once approved, FENOC plans to implement the amendment within 60 days.

There are no regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Phil H. Lashley, Supervisor – Fleet Licensing, at 330-315-6808.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 25, 2012.

Sincerely,

Paul A. Harden

Enclosure:
Evaluation of the Proposed Amendment

cc: NRC Region I Administrator
NRC Resident Inspector
NRC Project Manager
Director BRP/DEP
Site BRP/DEP Representative

Evaluation of the Proposed Amendment

Subject: License Amendment Request for the Exemption of TS 3.1.3 Moderator Temperature Coefficient Measurement Under Certain Conditions

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1. Proposed Technical Specification Changes (Mark-ups)
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3. Proposed Technical Specification Bases Changes (For Information Only)
4. Proposed Core Operating Limits Report (COLR) Changes (For Information Only)

1.0 SUMMARY DESCRIPTION

The proposed changes revise the near-end of life (EOL)[1] moderator temperature coefficient (MTC) Surveillance Requirement (SR) 3.1.3.2 by placing a set of conditions on reactor core operation, which if met, would allow exemption from the required MTC measurement. The conditional exemption would be determined on a cycle-specific basis by verifying a conservatively calculated predicted MTC is less negative than the surveillance required MTC limit and specified reactor core parameters are consistent with established design criteria as a function of burn-up. The conditional exemption would improve plant availability and minimize disruptions to normal plant operation without a decrease in safety. It does not involve a design modification or physical change to the plant, and it does not change methods of plant operation or maintenance of equipment important to safety.

2.0 DETAILED DESCRIPTION

The proposed changes are:

1. SR 3.1.3.2 would be revised to exempt the requirement for a near-EOL MTC measurement if specified benchmark criteria and Core Operating Limits Report (COLR) requirements for near-EOL MTC are satisfied.

2. WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997, would be added to the list of references for the COLR in Technical Specification (TS) 5.6.3.b.

One of the controlling parameters for core reactivity is the MTC. The requirements of TS 3.1.3, "Moderator Temperature Coefficient (MTC)," ensure that the MTC remains within the bounds specified in the Beaver Valley Power Station, Unit 1 and Unit 2 (BVPS) Updated Final Safety Analysis Report (UFSAR) accident analyses contained in Chapter 14 for Unit 1 and Chapter 15 for Unit 2. This ensures stable power operations during normal operation and analyzed accident conditions, such as overheating and overcooling events.

The TS 3.1.3 places limits on the MTC based on the accident analysis assumptions for the moderator density coefficient. A positive moderator density coefficient corresponds to a negative MTC. The most negative MTC limiting condition for operation (LCO) limit requires that the MTC be less negative than the specified limit

[1] The acronyms EOL and EOC (end of cycle) can be used interchangeably. The BVPS TS Bases use the acronym EOC and the WCAP-13749-P-A uses the acronym EOL. In order to remain consistent with the WCAP-13749-P-A, the acronym EOL, rather than the acronym EOC, will be used in this evaluation of the proposed amendment.

for the all rods withdrawn, EOL, rated thermal power (RTP)[2] condition. To demonstrate compliance with the most negative MTC LCO, the surveillance requires verification of the MTC after 300 parts per million (ppm) equilibrium boron concentration is reached. From the time that 300 ppm is reached until EOL, the hot full power (HFP) MTC will gradually become more negative due to additional core burnup and boron concentration reduction. To account for this effect, the 300 ppm MTC surveillance limit is sufficiently less negative than the EOL LCO limit to ensure that the LCO limit will be met as long as the 300 ppm MTC surveillance criterion is met.

Currently, TS 3.1.3 requires measurements of MTC at beginning of life (BOL)[3] to verify the most positive MTC limit and at near-EOL to verify the most negative MTC limit. At BOL, the measurement of the isothermal temperature coefficient is relatively simple to perform since it is performed at hot zero power (HZP) isothermal conditions and is not complicated by changes in the reactor coolant enthalpy rise or the presence of xenon. The measurement made near-EOL is performed at or near HFP conditions. MTC measurements at HFP are more difficult to perform than at HZP due to small variations in soluble boron concentration, changes in xenon concentration and distribution, changes in fuel temperature, and changes in reactor coolant enthalpy rise created by small changes in the core average power during the measurement. Unless changes in each of these parameters are accounted for when reducing the measurement data, additional measurement uncertainties would be introduced. Although these additional uncertainties and the total reactivity change associated with the swing in moderator temperature would be minimal, the resulting MTC measurement uncertainty created by even a small change in power level could become significant and, if improperly accounted for, could yield inaccurate measurement results.

The MTC measurement typically includes time at reduced power as a result of the MTC determination measurement procedures. Additional manpower is also required to perform the test. This measurement disrupts normal reactor operation and increases the potential for a reactivity event due to a human performance error or unanticipated equipment issues. Therefore, in order to improve availability and minimize disruptions to normal reactor operation, FirstEnergy Nuclear Operating Company (FENOC) proposes an alternative to the EOL MTC measurement. If predefined conditions are met, the SR 3.1.3.2 EOL MTC measurement would be

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[2] The acronyms RTP and HFP (hot full power) can be used interchangeably. The BVPS TS and TS Bases use the acronym RTP and the WCAP-13749-P-A uses both RTP and HFP. In this evaluation of the proposed amendment, use of acronyms RTP and HFP will remain consistent with their prescribed use in WCAP-13749-P-A.

[3] The acronyms BOL and BOC (beginning of cycle) can be used interchangeably. The BVPS TS Bases use the acronym BOC and the WCAP-13749-P-A uses the acronym BOL. In order to remain consistent with the WCAP-13749-P-A, the acronym BOL, rather than the acronym BOC, will be used in this evaluation of the proposed amendment.

replaced by a calculated verification of an acceptable margin to the surveillance required MTC limit.

The proposed change would modify the EOL MTC surveillance requirement by placing a set of conditions on core operations. If these conditions are met, that is, the specified revised prediction of the MTC and several core parameters measured during the cycle are within specified bounds, performing the surveillance measurement would not be required.

3.0 TECHNICAL EVALUATION

The conditional exemption from the HFP near-EOL 300 ppm MTC measurement would not impact the BVPS safety analyses. The safety analyses assumption of a constant moderator density coefficient and the actual value assumed would not change. The bases for and values of the most negative MTC limiting condition for operation and for the surveillance limit would not be altered. Instead, a revised prediction would be compared to the MTC surveillance limit to determine if the limit is met. The method for calculating the revised prediction would be consistent with the NRC-approved methodology contained in WCAP-13749-P-A.

The methodology associated with the proposed change was submitted to the Nuclear Regulatory Commission (NRC) in Westinghouse topical report WCAP-13749-P in June 1993. In October 1996, the NRC determined the methodology described in WCAP-13749-P to be suitably conservative and acceptable for referencing in license applications, provided:

1. Only PHOENIX/ANC calculation methods are used for the individual plant analyses relevant to determinations for the EOL MTC plant methodology, and

2. The predictive correction is reexamined if changes in core fuel designs or continued MTC calculation/measurement data show significant effect on the predictive correction.

As discussed below, BVPS would meet both of these requirements.

The PHOENIX/ANC calculation methods are currently used to develop the BVPS core designs. However, Westinghouse plans to transition from nuclear calculations performed using the PHOENIX-P lattice code to generate cross-section data to those performed with the PARAGON lattice code. The March 18, 2004 NRC safety evaluation regarding WCAP-16045-P, "Qualification of the Two-Dimensional Transport Code PARAGON," concluded that, "The PARAGON code can be used as a replacement for the PHOENIX-P lattice code, wherever the PHOENIX-P code is used in NRC-approved methodologies." Based on this conclusion, future core design calculations using the PARAGON/ANC system would be equivalent to those performed using the PHOENIX/ANC system and would be consistent with the requirements of WCAP-13749-P-A.

Additionally, prior to conditional exemption, FENOC would confirm on a cycle-specific basis that core fuel design changes or MTC calculation/measurement data do not show a significant effect on the predictive correction. The administrative controls for this confirmation would reside in the BVPS procedures that control the EOL MTC surveillance. If a significant effect is found, the use of the predictive correction would be re-examined.

All of the core performance benchmark criteria, which are confirmed from startup physics test results, routine HFP boron concentration measurements, and flux map surveillances performed during the cycle, must be met before the revised predicted MTC can be calculated in accordance with the prescribed algorithm contained in WCAP-13749-P-A.

FENOC proposes to include the following in the BVPS COLRs:

- a BVPS cycle-specific figure equivalent to WCAP-13749-P-A Figure 3-1, "Example of Predicted HFP ARO [all rods out] 300 ppm MTC Versus Cycle Burnup"

- the WCAP-13749-P-A algorithm to calculate the revised predicted MTC

FENOC proposes to include the following in the BVPS surveillance procedures associated with the EOL MTC measurement:

- verification that the parameters listed in WCAP-13749-P-A Table 3-2, "Benchmark Criteria for Application of the 300 PPM MTC Conditional Exemption Methodology," are met

- detailed instructions for calculating the revised predicted MTC

- verification that the revised predicted MTC meets the 300 ppm surveillance limit

As WCAP-13749-P-A provides the basis for this license amendment request and conditional exemption criteria, FENOC would meet the criteria for application included in WCAP-13749-P-A, but proposes an exemption that would reduce an administrative burden for both FENOC and the NRC. FENOC proposes not to submit a "Most Negative Moderator Temperature Coefficient Limit Report" to the NRC for the two reasons discussed below.

First, there is an inconsistency in WCAP-13749-P-A regarding the data collection time frame and the report submittal time frame.

WCAP-13749-P-A, Section 3.3.3, "Application of the Conditional Exemption Methodology," states:

> The Technical Specification Bases of the most negative MTC LCO and SR and the values of these limits are not altered. Instead, a revised prediction is compared to the SR MTC to determine if the SR limit is met. The revised prediction is simply the sum of the predicted HFP 300 ppm SR MTC plus an axial flux difference (AFD) correction factor plus a predictive correction term.

Table D-2 of WCAP-13749-P-A, "(Table 2) Algorithm for Determining the Revised Predicted Near-EOL 300 ppm MTC," states that the algorithm for determining the revised predicted near-EOL is:

> The revised predicted MTC = Predicted MTC + AFD Correction + Predictive Correction
>
> where:
>
> Predicted MTC is calculated from Figure 1 [(Figure D-1) Predicted HFP ARO 300 ppm MTC Versus Cycle Burnup] ***at the burnup corresponding to the measurement of 300 ppm*** at RTP conditions...

Table D-3 of WCAP-13749-P-A is an "...Example Worksheet for Calculating the Revised Predicted Near-EOL 300 PPM MTC." Two of the required data inputs for this worksheet (B.1 and B.2) are used to calculate the AFD correction term in the algorithm:

> B.1 Burnup of ***most recent HFP***, equilibrium _____ MWD/MTU (cycle burnup) conditions incore flux map
>
> B.2 Measured HFP AFD at burnup (B.1) _____ % AFD

However, Appendix A, "Technical Specification Revisions with COLR," of WCAP-13749-P-A requires the addition of a new Specification 6.9.1.7. In the Improved Standard Technical Specification (ISTS) format, this would be Specification 5.6.7. If incorporated, the new TS 5.6.7 would state in part:

> The most negative MTC limits shall be provided to the NRC Regional Administrator...***at least 60 days prior to the date the limit would become effective unless otherwise approved by the Commission by letter. This report will include the data required for the determination of the Revised Prediction*** of the 300 ppm/ARO/RTP MTC per WCAP-13749 [-P-A]...

Since the "Most Negative Moderator Temperature Coefficient Limit Report" would have to be submitted at least 60 days before reaching the 300 ppm boron

concentration, it cannot include the 300 ppm data required for determining the revised prediction. To meet the "Most Negative Moderator Temperature Coefficient Limit Report" submittal requirement, the data to be used for calculating the revised predicted MTC would have to be collected 60 to 90 days prior to reaching 300 ppm boron. However, WCAP-13749-P-A does not provide a method for adjusting the revised predicted MTC to account for data collected 60 to 90 days prior to reaching the 300 ppm boron concentration nor does it provide justification for using such early data in the calculation. Therefore, the requirement to submit the "Most Negative Moderator Temperature Coefficient Limit Report" at least 60 days prior to the date the limit would become effective and the collection requirements for the data that go into the report are inconsistent.

Additionally, submittal of a "Most Negative Moderator Temperature Coefficient Limit Report" has no apparent technical requirement. The applicability restrictions, the algorithm, and the acceptance criteria contained in WCAP-13749-P-A, would be included in either the BVPS procedures governing the EOL MTC surveillance or the COLR. As such, NRC notification of surveillance performance is not necessary.

This proposed exemption of not incorporating the WCAP-13749-P-A, new Specification 5.6.7 (ISTS format) requirement and not submitting a "Most Negative Moderator Temperature Coefficient Limit Report" was approved by the NRC for Seabrook Unit 1 on February 17, 2006.

4.0 REGULATORY EVALUATION

FirstEnergy Nuclear Operating Company (FENOC) proposes to amend the Beaver Valley Power Station, Unit Nos. 1 and 2 Operating Licenses DPR-66 and NPF-73, respectively.

The requested amendment involves a change to the Technical Specifications (TS) that would conditionally exempt the end of life moderator temperature coefficient measurement under certain conditions. This conditional exemption would minimize disruptions to normal reactor operation and decrease the potential for a reactivity event due to a human performance error or unanticipated equipment issues. The proposed amendment does not involve a design modification or physical change to the plant, and does not change methods of plant operation or maintenance of equipment important to safety.

4.1 Significant Hazards Consideration Analysis

FirstEnergy Nuclear Operating Company has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   This amendment request would change the near-end of life (EOL) moderator temperature coefficient (MTC) surveillance requirement (SR) to allow exemption from the required MTC measurement under certain conditions. This change would not result in physical alteration of a plant structure, system or component, or installation of new or different types of equipment. Modification of the surveillance requirement under certain conditions would not affect the probability of accidents previously evaluated in the Updated Final Safety Analysis Report (UFSAR) or cause a change to any of the dose analyses associated with the UFSAR accidents because accident mitigation functions would remain unchanged. Existing MTC TS limits would remain unchanged and would continue to be satisfied.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No

   This amendment request would change the near EOL MTC SR to allow exemption from the required MTC measurement under certain conditions. No new accident scenarios, failure mechanisms, or limiting single failures are introduced as a result of the proposed change. No physical plant alterations are made as a result of the proposed change. The proposed change does not challenge the performance or integrity of any safety-related system. MTC is a variable that must remain within limits but is not an accident initiator.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No

   This amendment request would change the near EOL MTC SR to allow exemption from the required MTC measurement under certain conditions. The margin of safety associated with the acceptance criteria of accidents previously evaluated in the UFSAR is unchanged. The proposed change would have no affect on the availability, operability, or performance of the safety-related systems and components. A change to a surveillance is

proposed based on an alternate method of confirming that the surveillance requirement is met. The Technical Specification limiting condition for operation (LCO) limits for MTC remain unchanged.

The Technical Specifications establish limits for the moderator temperature coefficient based on assumptions in the UFSAR accident analyses. Applying the conditional exemption from the moderator temperature coefficient measurement changes the method of meeting the surveillance requirement; however this change does not modify the TS values and ensures adherence to the current TS limits. The basis for derivation of the moderator temperature coefficient limits from the moderator density coefficient assumed in the accident analysis would not change.

Therefore, the margin of safety as defined in the TS is not reduced and the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, FENOC concludes that the proposed amendment involves no significant hazards consideration under the criteria set forth in 10 CFR 50.92 and, accordingly, a finding of "no significant hazards consideration" is justified.

4.2 Applicable Regulatory Requirements / Criteria

Changes described in the license amendment request would not affect plant design nor change MTC limits, and therefore FENOC would remain in compliance with the following regulations:

10 CFR 50, Appendix A, “General Design Criteria for Nuclear Power Plants,” GDC 1, “Quality Standards and Records,” requires the structures, systems, and components important to safety to be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function.

GDC 10, “Reactor design,” requires the reactor core and associated coolant, control, and protection systems to be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.

GDC 11, “Reactor inherent protection,” requires the reactor core and associated coolant systems to be designed so that in the power operating range the net effect of the prompt inherent nuclear feedback characteristics tends to compensate for a rapid increase in reactivity.

10 CFR 50.36, "Technical specifications," requires a licensee's TS to establish limiting conditions for operation and surveillance requirements for equipment that is required for safe operation of the facility. Specifically, 10 CFR 50.36(c)(3) describes surveillance requirements.

4.3 Precedent

NRC letter to FPL Energy Seabrook, LLC, Subject: Seabrook Station, Unit No. 1 – Issuance of Amendment Re: Removal of Requirement to Perform End-of-life Moderator Temperature Coefficient Measurement (TAC No. MC6566), February 17, 2006.

4.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 REFERENCES

1. WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997.

2. WCAP-16045-P-A, "Qualification of the Two-Dimensional Transport Code PARAGON," August 2004.

Attachment 1

Beaver Valley Power Station, Unit Nos. 1 and 2

Proposed Technical Specification Changes

The following lists the pages included within Attachment 1:

3.1.3-1*
3.1.3-2
5.6-2
5.6-3

* No Change proposed. Included for context.

No change proposed. Included for Context.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.3 Moderator Temperature Coefficient (MTC)

LCO 3.1.3 The MTC shall be maintained within the limits specified in the COLR. The maximum upper limit shall be that specified in Figure 3.1.3-1.

APPLICABILITY: MODE 1 and MODE 2 with $k_{eff} \geq 1.0$ for the upper MTC limit, MODES 1, 2, and 3 for the lower MTC limit.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MTC not within upper limit.	A.1 Establish administrative withdrawal limits for control banks to maintain MTC within limit.	24 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 2 with $k_{eff} < 1.0$.	6 hours
C. MTC not within lower limit.	C.1 Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.3.1	Verify MTC is within upper limit.	Prior to entering MODE 1 after each refueling

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.3.2	---------- **- NOTES -** 1. Not required to be performed until 7 effective full power days (EFPD) after reaching the equivalent of an equilibrium RTP all rods out (ARO) boron concentration of 300 ppm. 2. If the MTC is more negative than the 300 ppm Surveillance limit (not LCO limit) specified in the COLR, SR 3.1.3.2 shall be repeated once per 14 EFPD during the remainder of the fuel cycle. 3. SR 3.1.3.2 need not be repeated if the MTC measured at the equivalent of equilibrium RTP-ARO boron concentration of ≤ 60 ppm is less negative than the 60 ppm Surveillance limit specified in the COLR. 4. SR 3.1.3.2 is not required to be performed provided that the benchmark criteria specified in WCAP-13749-P-A and the COLR requirements for the calculated revised predicted MTC are satisfied. ----------	
	Verify MTC is within lower limit.	Once each cycle

5.6 Reporting Requirements

5.6.3 CORE OPERATING LIMITS REPORT (COLR) (continued)

LCO 3.1.5, "Shutdown Bank Insertion Limits"

LCO 3.1.6, "Control Bank Insertion Limits"

LCO 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)"

LCO 3.2.2, "Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)"

LCO 3.2.3, "Axial Flux Difference (AFD)"

LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation" - Overtemperature and Overpower ΔT Allowable Value parameter values

LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits"

LCO 3.9.1, "Boron Concentration"

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology,"

WCAP-8745-P-A, "Design Bases for the Thermal Overtemperature ΔT and Thermal Overpower ΔT Trip Functions,"

WCAP-12945-P-A, Volumes 1 through 5, "Code Qualification Document for Best Estimate LOCA Analysis,"

(For Unit 1 only) WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using Automated Statistical Treatment of Uncertainty Method (ASTRUM),"

WCAP-10216-P-A, "Relaxation of Constant Axial Offset Control/ F_Q Surveillance Technical Specification,"

WCAP-14565-P-A, "VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis,"

WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report,"

WCAP-15025-P-A, "Modified WRB-2 Correlation, WRB-2M, for Predicating Critical Heat Flux in 17x17 Rod Bundles with Modified LPD Mixing Vane Grids."

WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997 (Westinghouse Proprietary).

5.6 Reporting Requirements

5.6.3 CORE OPERATING LIMITS REPORT (COLR) (continued)

As described in reference documents listed above, when an initial assumed power level of 102% of RATED THERMAL POWER is specified in a previously approved method, 100.6% of RATED THERMAL POWER may be used when input for reactor thermal power measurement of feedwater flow is by the leading edge flow meter (LEFM).

Caldon, Inc. Engineering Report-80P, "Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM √ ™ System"

Caldon, Inc. Engineering Report-160P, "Supplement to Topical Report ER-80P: Basis for a Power Uprate with the LEFM √ ™ System"

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

5.6.4 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heat up, cooldown, low temperature operation, criticality, and hydrostatic testing, Overpressure Protection System (OPPS) enable temperature, and PORV lift settings as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," and

LCO 3.4.12, "Overpressure Protection System (OPPS)"

b. The analytical methods used to determine the RCS pressure and temperature limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

NRC Letter, "Beaver Valley Power Station, Units 1 and 2 – Acceptance of Methodology for Referencing Pressure and Temperature Limits Report (TAC Nos. MB3319 and MB3320)," dated October 8, 2002.

WCAP-14040-NP-A, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves."

The methodology listed in WCAP-14040-NP-A was used with two exceptions:

- ASME Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limits for Section XI, Division 1."

Attachment 2

Beaver Valley Power Station, Unit Nos. 1 and 2

Retyped Technical Specification Pages

The following lists the pages included within Attachment 2:

3.1.3-2
5.6-2
5.6-3

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.3.2	---------- **- NOTES -** 1. Not required to be performed until 7 effective full power days (EFPD) after reaching the equivalent of an equilibrium RTP all rods out (ARO) boron concentration of 300 ppm. 2. If the MTC is more negative than the 300 ppm Surveillance limit (not LCO limit) specified in the COLR, SR 3.1.3.2 shall be repeated once per 14 EFPD during the remainder of the fuel cycle. 3. SR 3.1.3.2 need not be repeated if the MTC measured at the equivalent of equilibrium RTP-ARO boron concentration of ≤ 60 ppm is less negative than the 60 ppm Surveillance limit specified in the COLR. 4. SR 3.1.3.2 is not required to be performed provided that the benchmark criteria specified in WCAP-13749-P-A and the COLR requirements for the calculated revised predicted MTC are satisfied. ----------	
	Verify MTC is within lower limit.	Once each cycle

5.6 Reporting Requirements

5.6.3 CORE OPERATING LIMITS REPORT (COLR) (continued)

LCO 3.1.5, "Shutdown Bank Insertion Limits"

LCO 3.1.6, "Control Bank Insertion Limits"

LCO 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)"

LCO 3.2.2, "Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)"

LCO 3.2.3, "Axial Flux Difference (AFD)"

LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation" - Overtemperature and Overpower ΔT Allowable Value parameter values

LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits"

LCO 3.9.1, "Boron Concentration"

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

WCAP-9272-P-A, "Westinghouse Reload Safety Evaluation Methodology,"

WCAP-8745-P-A, "Design Bases for the Thermal Overtemperature ΔT and Thermal Overpower ΔT Trip Functions,"

WCAP-12945-P-A, Volumes 1 through 5, "Code Qualification Document for Best Estimate LOCA Analysis,"

(For Unit 1 only) WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using Automated Statistical Treatment of Uncertainty Method (ASTRUM),"

WCAP-10216-P-A, "Relaxation of Constant Axial Offset Control/ F_Q Surveillance Technical Specification,"

WCAP-14565-P-A, "VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis,"

WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report,"

WCAP-15025-P-A, "Modified WRB-2 Correlation, WRB-2M, for Predicating Critical Heat Flux in 17x17 Rod Bundles with Modified LPD Mixing Vane Grids."

WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997 (Westinghouse Proprietary).

5.6 Reporting Requirements

5.6.3 CORE OPERATING LIMITS REPORT (COLR) (continued)

As described in reference documents listed above, when an initial assumed power level of 102% of RATED THERMAL POWER is specified in a previously approved method, 100.6% of RATED THERMAL POWER may be used when input for reactor thermal power measurement of feedwater flow is by the leading edge flow meter (LEFM).

Caldon, Inc. Engineering Report-80P, "Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM √ ™ System"

Caldon, Inc. Engineering Report-160P, "Supplement to Topical Report ER-80P: Basis for a Power Uprate with the LEFM √ ™ System"

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

5.6.4 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heat up, cooldown, low temperature operation, criticality, and hydrostatic testing, Overpressure Protection System (OPPS) enable temperature, and PORV lift settings as well as heatup and cooldown rates shall be established and documented in the PTLR for the following:

LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," and

LCO 3.4.12, "Overpressure Protection System (OPPS)"

b. The analytical methods used to determine the RCS pressure and temperature limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

NRC Letter, "Beaver Valley Power Station, Units 1 and 2 – Acceptance of Methodology for Referencing Pressure and Temperature Limits Report (TAC Nos. MB3319 and MB3320)," dated October 8, 2002.

WCAP-14040-NP-A, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves."

The methodology listed in WCAP-14040-NP-A was used with two exceptions:

- ASME Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limits for Section XI, Division 1."

Attachment 3

Beaver Valley Power Station, Unit Nos. 1 and 2

Proposed Technical Specification Bases Changes

The following lists the pages included within Attachment 3:

B 3.1.3-2
B 3.1.3-3
B 3.1.3-4*
B 3.1.3-5
B 3.1.3-6
B 3.1.3-7

* No Change proposed. Included for context.

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BASES

BACKGROUND (continued)

The SRs for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits, since this coefficient changes slowly, due principally to the reduction in RCS boron concentration associated with fuel burnup.

APPLICABLE SAFETY ANALYSES

The acceptance criteria for the specified MTC are:

a. The MTC values must remain within the bounds of those used in the accident analysis (Ref. 2) and

b. The MTC must be such that inherently stable power operations result during normal operation and accidents, such as overheating and overcooling events.

The UFSAR (Ref. 2), contains analyses of accidents that result in both overheating and overcooling of the reactor core. MTC is one of the controlling parameters for core reactivity in these accidents. Both the most positive value and most negative value of the MTC are important to safety, and both values must be bounded. Values used in the analyses consider worst case conditions to ensure that the accident results are bounding (Ref. 3).

The consequences of accidents that cause core overheating must be evaluated when MTC is positive. Such accidents include Rod Withdrawal from Subcritical (Ref. 4), Rod Withdrawal at Power (Ref. 5), Loss of Normal Feedwater Flow (Ref. 6), Loss of Offsite Power (Ref. 7), Loss of Electrical Load (Ref. 8), RCS Depressurization (Ref. 9), Loss of Flow (Ref. 10), Locked Rotor (Ref. 11) and Rod Ejection (Ref. 12). The consequences of accidents that cause core overcooling must be evaluated when MTC is negative. Such accidents include Feedwater Flow Increase (Ref. 13), Feedwater Temperature Decrease (Ref. 14) and Steamline Break (Ref. 15).

In order to ensure a bounding accident analysis, the MTC is assumed to be its most limiting value for the analysis conditions appropriate to each accident. The bounding value is determined by considering rodded and unrodded conditions, whether the reactor is at full or zero power, and whether it is the BOC or EOC life. The most conservative combination appropriate to the accident is then used for the analysis (Ref. 2).

MTC values are bounded in reload safety evaluations assuming steady state conditions at BOC and EOC. An EOC measurement or analytical check (Ref. 16) of the EOC MTC is conducted when the RCS boron concentration reaches approximately 300 ppm. The measured or calculated value may be extrapolated to project the EOC value, in order to confirm reload design predictions.

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BASES

APPLICABLE SAFETY ANALYSES (continued)

MTC satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii). Even though it is not directly observed and controlled from the control room, MTC is considered an initial condition process variable because of its dependence on boron concentration.

LCO

LCO 3.1.3 requires the MTC to be within specified limits of the COLR and Figure 3.1.3-1 to ensure that the core operates within the assumptions of the accident analysis. During the reload core safety evaluation, the MTC is analyzed to determine that its values remain within the bounds of the original accident analysis during operation.

Assumptions made in the safety analyses require that the MTC be less positive than a given upper bound and more positive than a given lower bound. The maximum upper (most positive) MTC limit occurs near BOC, all rods out (ARO), hot zero power (HZP), no xenon (NoXe) conditions. Note that in cores containing substantial amounts of burnable absorber in the form of Integral Fuel Burnable Absorber (IFBA), the burnup of most positive MTC under the above conditions may not be at startup, but at some point up to 100 EFPD after startup. If the core never returns to HZP conditions over this period of operations, this most positive MTC may never be physically realized. At EOC the MTC takes on its most negative value, when the lower bound becomes important. This LCO exists to ensure that both the upper and lower bounds are not exceeded.

~~During operation, therefore, the conditions of the LCO can only be ensured through measurement.~~During operation, the upper MTC limit can only be ensured through measurement. The lower MTC limit can be ensured either through measurement or by ensuring the benchmark criteria in WCAP-13749-P-A and the COLR requirements for the calculated revised predicted MTC are satisfied. The Surveillance checks at BOC and EOC on MTC provide confirmation that the MTC is behaving as anticipated so that the acceptance criteria are met.

The LCO establishes a maximum positive value that cannot be exceeded. The BOC positive limit is established in Figure 3.1.3-1 and the EOC negative limit is established in the COLR to allow specifying limits for each particular cycle. This permits the unit to take advantage of improved fuel management and changes in unit operating schedule.

APPLICABILITY

Technical Specifications place both LCO and SR values on MTC, based on the safety analysis assumptions described above.

In MODE 1, the limits on MTC must be maintained to ensure that any accident initiated from THERMAL POWER operation will not violate the design assumptions of the accident analysis. In MODE 2 with the reactor

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BASES

APPLICABILITY (continued)

critical, the upper limit must also be maintained to ensure that startup and subcritical accidents (such as the uncontrolled CONTROL ROD assembly or group withdrawal) will not violate the assumptions of the accident analysis. The lower MTC limit must be maintained in MODES 2 and 3, in addition to MODE 1, to ensure that cooldown accidents will not violate the assumptions of the accident analysis. In MODES 4, 5, and 6, this LCO is not applicable, since no Design Basis Accidents using the MTC as an analysis assumption are initiated from these MODES.

ACTIONS

A.1

If the BOC upper MTC limit is violated, administrative withdrawal limits for control banks must be established to maintain the MTC within its limits. The MTC becomes more negative with control bank insertion and decreased boron concentration. A Completion Time of 24 hours provides enough time for evaluating the MTC measurement and computing the required bank withdrawal limits.

As cycle burnup is increased, the RCS boron concentration will, in general, be reduced. Note that in cores containing substantial amounts of burnable absorber in the form of IFBA, the core critical boron concentration may actually slowly increase over the first 100 EFPD after startup because the increase in reactivity due to the burnout of the IFBA may be greater than the decrease in reactivity due to the depletion of the fuel. Using physics calculations, the times in cycle life at which the calculated MTC will meet the LCO requirements can be determined. Note that since the RCS boron concentration can increase over the first 100 EFPD, the calculated MTC may meet the LCO requirement at startup and still not meet the LCO requirement later in the cycle. At the points in core life when the calculated MTC meets the LCO requirement, Condition A no longer exists. The unit is no longer in the Required Action, so the administrative withdrawal limits are no longer in effect.

B.1

If the required administrative withdrawal limits at BOC are not established within 24 hours, the unit must be brought to MODE 2 with $k_{eff} < 1.0$ to prevent operation with an MTC that is more positive than that assumed in safety analyses.

The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full power conditions in an orderly manner and without challenging plant systems.

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BASES

ACTIONS (continued)

C.1

Exceeding the EOC MTC limit means that the safety analysis assumptions for the EOC accidents that use a bounding negative MTC value may be invalid. If the EOC MTC limit is exceeded, the plant must be brought to a MODE or condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 4 within 12 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching the required MODE from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.1.3.1

This SR requires measurement of the MTC at BOC prior to entering MODE 1 in order to demonstrate compliance with the most positive MTC LCO. Meeting the limit prior to entering MODE 1 ensures that the limit will also be met at higher power levels.

The BOC MTC value for ARO will be inferred from isothermal temperature coefficient measurements obtained during the physics tests after refueling. The ARO value can be directly compared to the BOC MTC limit of the LCO. If required, measurement results and predicted design values can be used to establish administrative withdrawal limits for control banks.

SR 3.1.3.2

In similar fashion, the LCO demands that the MTC be less negative than the specified value for EOC full power conditions. This measurement may be performed at any THERMAL POWER, but its results must be extrapolated and/or compensated to the conditions of RTP and all banks withdrawn in order to make a proper comparison with the LCO value. Because the RTP MTC value will gradually become more negative with further core depletion and boron concentration reduction, a 300 ppm SR value of MTC should necessarily be less negative than the EOC LCO limit. The 300 ppm SR value is sufficiently less negative than the EOC LCO limit value to ensure that the LCO limit will be met when the 300 ppm Surveillance criterion is met.

In order to assure an accurate result SR 3.1.3.2 must be performed after reaching the equivalent of an equilibrium RTP ARO boron concentration of 300 ppm. SR 3.1.3.2 is modified by ~~three~~ four Notes that include the following requirements:

SURVEILLANCE REQUIREMENTS (continued)

a. The SR is not required to be performed until 7 effective full power days (EFPDs) after reaching the equivalent of an equilibrium RTP ARO boron concentration of 300 ppm.

b. If the 300 ppm Surveillance limit is exceeded, it is possible that the EOC limit on MTC could be reached before the planned EOC. Because the MTC changes slowly with core depletion, the Frequency of 14 effective full power days is sufficient to avoid exceeding the EOC limit.

c. The Surveillance limit for RTP boron concentration of 60 ppm is conservative. If the measured MTC at 60 ppm is more positive than the 60 ppm Surveillance limit, the EOC limit will not be exceeded because of the gradual manner in which MTC changes with core burnup.

d. SR 3.1.3.2 is not required to be performed provided that the benchmark criteria specified in WCAP-13749-P-A and the COLR requirements for the calculated revised predicted MTC are satisfied.

REFERENCES

1. Unit 1 UFSAR Appendix 1A, "1971 AEC General Design Criteria Conformance" and Unit 2 UFSAR Section 3.1, "Conformance with U.S. Nuclear Regulatory Commission General Design Criteria."
2. UFSAR Chapter 14 (Unit 1) and Chapter 15 (Unit 2).
3. WCAP 9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
4. UFSAR Section 14.1.1 (Unit 1) and Section 15.4.1 (Unit 2).
5. UFSAR Section 14.1.2 (Unit 1) and Section 15.4.2 (Unit 2).
6. UFSAR Section 14.1.8 (Unit 1) and Section 15.2.7 (Unit 2).
7. UFSAR Section 14.1.11 (Unit 1) and Section 15.2.6 (Unit 2).
8. UFSAR Section 14.1.7 (Unit 1) and Sections 15.2.2 and 15.2.3 (Unit 2).
9. UFSAR Section 14.1.15 (Unit 1) and Section 15.6.1 (Unit 2).
10. UFSAR Sections 14.1.5 and 14.2.9 (Unit 1) and Sections 15.3.1 and 15.3.2 (Unit 2).
11. UFSAR Section 14.2.7 (Unit 1) and Section 15.3.3 (Unit 2).
12. UFSAR Section 14.2.6 (Unit 1) and Section 15.4.8 (Unit 2).

BASES

REFERENCES (continued)

13. UFSAR Section 14.1.9 (Unit 1) and Section 15.1.2 (Unit 2).

14. UFSAR Section 14.1.9 (Unit 1) and Section 15.1.1 (Unit 2).

15. UFSAR Section 14.2.5.1 (Unit 1) and Section 15.1.5 (Unit 2).

16. WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997 (Westinghouse Proprietary).

Attachment 4

Beaver Valley Power Station, Unit Nos. 1 and 2

Proposed Core Operating Limits Report (COLR) Changes

The following lists the pages included within Attachment 4:

Unit 1
5.1-1
5.1-7
5.1-12

Unit 2
5.1-1
5.1-7
5.1-12

Note: As a result of the proposed changes, additional COLR pages other than those listed above would need to be repaginated. As no content change would be required, the pages requiring repagination are not included in this submittal.

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5.0 ADMINISTRATIVE CONTROLS

5.1 Core Operating Limits Report

This Core Operating Limits Report provides the cycle specific parameter limits developed in accordance with the NRC approved methodologies specified in Technical Specification Administrative Control 5.6.3.

5.1.1 SL 2.1.1 Reactor Core Safety Limits

See Figure 5.1-1.

5.1.2 SHUTDOWN MARGIN (SDM)

a. In MODES 1, 2, 3, and 4, SHUTDOWN MARGIN shall be ≥ 1.77% Δk/k.(1)

b. Prior to manually blocking the Low Pressurizer Pressure Safety Injection Signal, the Reactor Coolant System shall be borated to ≥ the MODE 5 boron concentration and shall remain ≥ this boron concentration at all times when this signal is blocked.

c. In MODE 5, SHUTDOWN MARGIN shall be ≥ 1.0% Δk/k.

5.1.3 LCO 3.1.3 Moderator Temperature Coefficient (MTC)

a. Upper Limit - MTC shall be maintained within the acceptable operation limit specified in Technical Specification Figure 3.1.3-1.

b. Lower Limit - MTC shall be maintained less negative than - 4.4 x 10^{-4} Δk/k/°F at RATED THERMAL POWER.

c. 300 ppm Surveillance Limit: (- 37 pcm/°F)

d. The revised predicted near-EOL 300 ppm MTC shall be calculated using Figure 5.1-5 and the following algorithm from Reference 11:

Revised predicted MTC = Predicted MTC + AFD Correction + Predictive Correction

If the revised predicted MTC is less negative than the SR 3.1.3.2 limit (COLR 5.1.3.c) and the benchmark criteria contained in WCAP-13749-P-A are met, then an MTC measurement in accordance with SR 3.1.3.2 is not required.

~~d~~e. 60 ppm Surveillance Limit: (- 43 pcm/°F)

(1) The MODE 1 and MODE 2 with k_{eff} ≥ 1.0 SDM requirements are included to address SDM requirements (e.g., MODE 1 Required Actions to verify SDM) that are not within the applicability of LCO 3.1.1, SHUTDOWN MARGIN (SDM).

5.1 Core Operating Limits Report

5.1.12 References

1. WCAP-9272-P-A, "WESTINGHOUSE RELOAD SAFETY EVALUATION METHODOLOGY," July 1985 (Westinghouse Proprietary).

2. WCAP-8745-P-A, "Design Bases for the Thermal Overtemperature ΔT and Thermal Overpower ΔT Trip Functions," September 1986.

3. WCAP-12945-P-A, Volume 1 (Revision 2) and Volumes 2 through 5 (Revision 1), "Code Qualification Document for Best Estimate LOCA Analysis," March 1998 (Westinghouse Proprietary).

4. WCAP-10216-P-A, Revision 1A, "Relaxation of Constant Axial Offset Control-F_Q Surveillance Technical Specification," February 1994.

5. WCAP-14565-P-A, "VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis," October 1999.

6. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report," April 1995 (Westinghouse Proprietary).

7. WCAP-15025-P-A, "Modified WRB-2 Correlation, WRB-2M, for Predicating Critical Heat Flux in 17x17 Rod Bundles with Modified LPD Mixing Vane Grids," April 1999.

8. Caldon, Inc. Engineering Report-80P, "Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM√™ System," Revision 0, March 1997.

9. Caldon, Inc. Engineering Report-160P, "Supplement to Topical Report ER-80P: Basis for a Power Uprate With the LEFM√™ System," Revision 0, May 2000.

10. WCAP-16009-P-A, "Realistic Large Break LOCA Evaluation Methodology Using Automated Statistical Treatment of Uncertainty Method (ASTRUM)," Revision 0, January 2005.

11. WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997 (Westinghouse Proprietary).

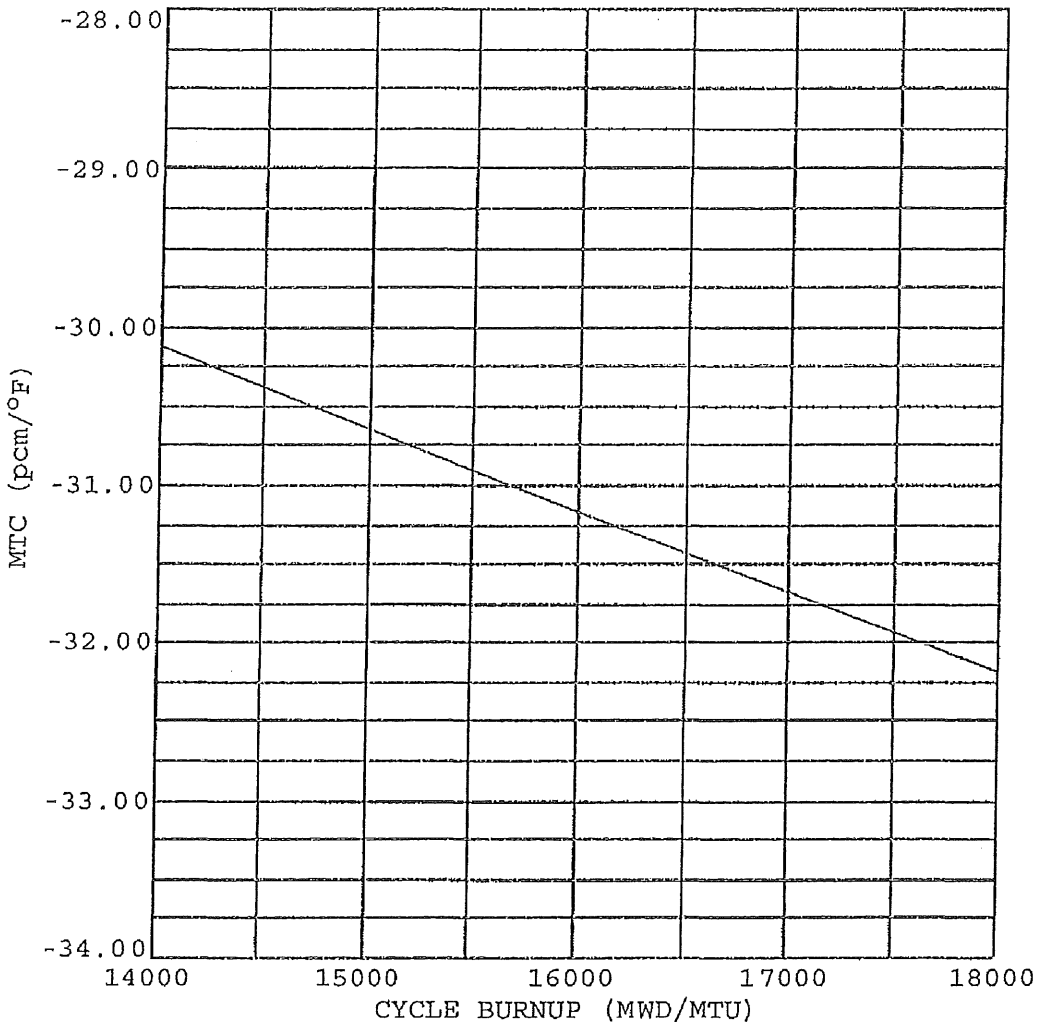

Figure 5.1-5 (Page 1 of 1)

PREDICTED HOT FULL POWER MODERATOR TEMPERATURE COEFFICIENT AS A FUNCTION OF THE CYCLE BURNUP WHEN 300 ppm BORON CONCENTRATION IS ATTAINED

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5.0 ADMINISTRATIVE CONTROLS

5.1 Core Operating Limits Report

This Core Operating Limits Report provides the cycle specific parameter limits developed in accordance with the NRC approved methodologies specified in Technical Specification Administrative Control 5.6.3.

5.1.1 SL 2.1.1 Reactor Core Safety Limits

See Figure 5.1-1.

5.1.2 SHUTDOWN MARGIN (SDM)

a. In MODES 1, 2, 3, and 4, SHUTDOWN MARGIN shall be ≥ 1.77% Δk/k.(1)

b. Prior to manually blocking the Low Pressurizer Pressure Safety Injection Signal, the Reactor Coolant System shall be borated to ≥ the MODE 5 boron concentration and shall remain ≥ this boron concentration at all times when this signal is blocked.

c. In MODE 5, SHUTDOWN MARGIN shall be ≥ 1.0% Δk/k.

5.1.3 LCO 3.1.3 Moderator Temperature Coefficient (MTC)

a. Upper Limit - MTC shall be maintained within the acceptable operation limit specified in Technical Specification Figure 3.1.3-1.

b. Lower Limit - MTC shall be maintained less negative than - 4.29 x 10^{-4} Δk/k/°F at RATED THERMAL POWER.

c. 300 ppm Surveillance Limit: (- 35 pcm/°F)

d. The revised predicted near-EOL 300 ppm MTC shall be calculated using Figure 5.1-5 and the following algorithm from Reference 10:

Revised predicted MTC = Predicted MTC + AFD Correction + Predictive Correction

If the revised predicted MTC is less negative than the SR 3.1.3.2 limit (COLR 5.1.3.c) and the benchmark criteria contained in WCAP-13749-P-A are met, then an MTC measurement in accordance with SR 3.1.3.2 is not required.

~~d~~e. 60 ppm Surveillance Limit: (- 41 pcm/°F)

(1) The MODE 1 and MODE 2 with k_{eff} ≥ 1.0 SDM requirements are included to address SDM requirements (e.g., MODE 1 Required Actions to verify SDM) that are not within the applicability of LCO 3.1.1, SHUTDOWN MARGIN (SDM).

5.1 Core Operating Limits Report

5.1.12 References

1. WCAP-9272-P-A, "WESTINGHOUSE RELOAD SAFETY EVALUATION METHODOLOGY," July 1985 (Westinghouse Proprietary).

2. WCAP-8745-P-A, "Design Bases for the Thermal Overtemperature ΔT and Thermal Overpower ΔT Trip Functions," September 1986.

3. WCAP-12945-P-A, Volume 1 (Revision 2) and Volumes 2 through 5 (Revision 1), "Code Qualification Document for Best Estimate LOCA Analysis," March 1998 (Westinghouse Proprietary).

4. WCAP-10216-P-A, Revision 1A, "Relaxation of Constant Axial Offset Control-F_Q Surveillance Technical Specification," February 1994.

5. WCAP-14565-P-A, "VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis," October 1999.

6. WCAP-12610-P-A, "VANTAGE+ Fuel Assembly Reference Core Report," April 1995 (Westinghouse Proprietary).

7. WCAP-15025-P-A, "Modified WRB-2 Correlation, WRB-2M, for Predicating Critical Heat Flux in 17x17 Rod Bundles with Modified LPD Mixing Vane Grids," April 1999.

8. Caldon, Inc. Engineering Report-80P, "Improving Thermal Power Accuracy and Plant Safety While Increasing Operating Power Level Using the LEFM√™ System," Revision 0, March 1997.

9. Caldon, Inc. Engineering Report-160P, "Supplement to Topical Report ER-80P: Basis for a Power Uprate With the LEFM√™ System," Revision 0, May 2000.

10. WCAP-13749-P-A, "Safety Evaluation Supporting the Conditional Exemption of the Most Negative EOL Moderator Temperature Coefficient Measurement," March 1997 (Westinghouse Proprietary).

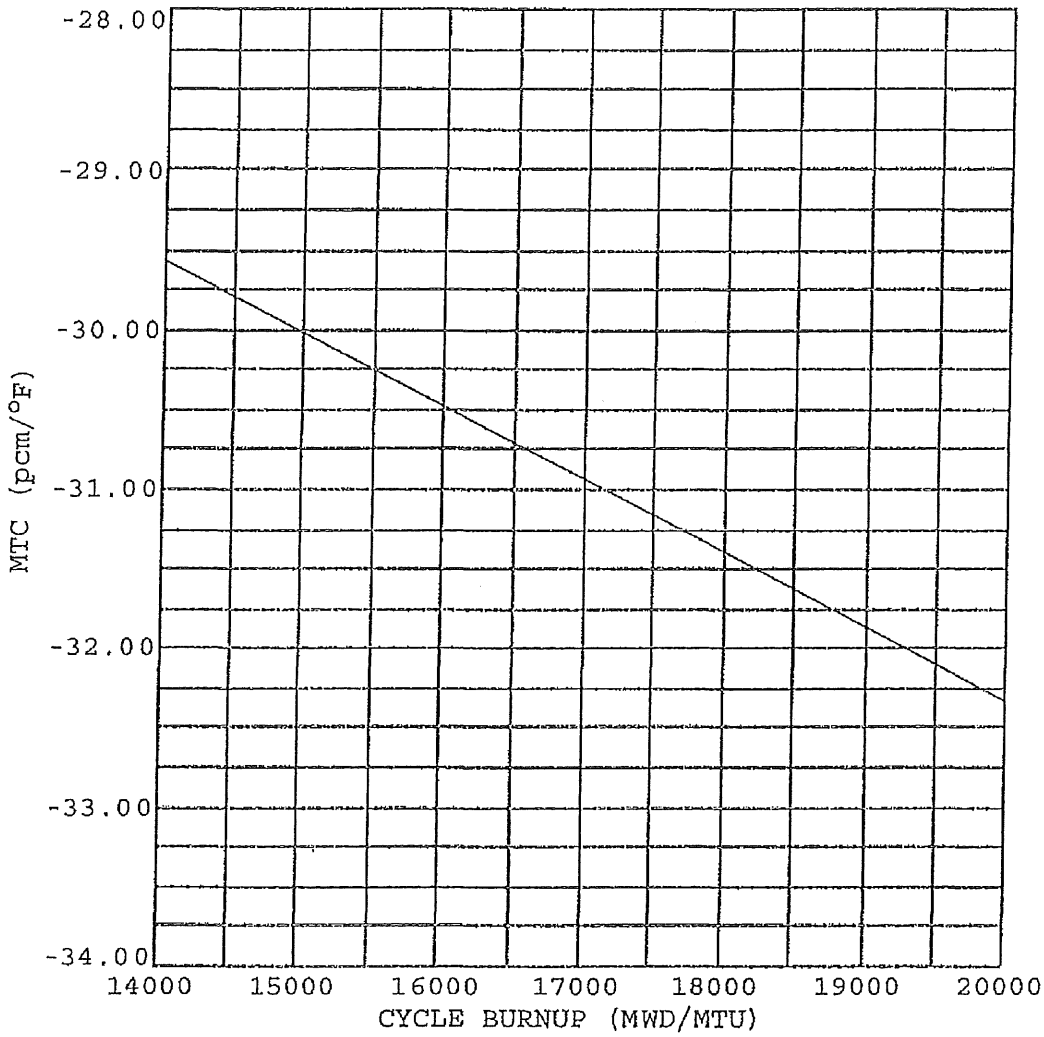

Figure 5.1-5 (Page 1 of 1)

PREDICTED HOT FULL POWER MODERATOR TEMPERATURE COEFFICIENT AS A FUNCTION OF THE CYCLE BURNUP WHEN 300 ppm BORON CONCENTRATION IS ATTAINED